

Remarks

Reconsideration of this Application is respectfully requested.

Claims 1-39 are pending in the application, with claims 1, 11, 22, 33 and 37 being the independent claims. No claims are sought to be cancelled. No new claims are sought to be added. No claims are sought to be amended.

The Examiner is asked to enter and consider this reply after final because it raises no new issues requiring further search and/or consideration and places the application in condition for allowance and/or better condition for appeal.

Based on the following remarks, Applicants respectfully request that the Examiner reconsider all outstanding rejections and that they be withdrawn.

Rejections under 35 U.S.C. § 112

The Examiner has rejected claims 1-39 under 35 U.S.C. § 112, first paragraph, for allegedly failing to comply with the enablement requirement. Applicants respectfully traverse this rejection.

The Specification Describes How to Make and Use the Invention

Applicants respectfully submit that the specification describes how to make and use the invention. As stated in the Manual of Patent Examining Procedure (M.P.E.P.) at § 2164.01, “the test for enablement is whether one reasonably skilled in the art could make or use the invention from the disclosures in the patent coupled with information known in the art without undue experimentation.” (*quoting U.S. v. Teletronics, Inc.*, 857 F.2d 778, 785 (Fed. Cir. 1988). *M.P.E.P. § 2164.01.*

Independent claim 1 is representative of the claim set 1-39, and recites the following:

An echo canceller comprising:

a combiner for combining a secondary audio signal and a far end primary telephony signal into a single combined reference signal, wherein the secondary audio signal comprises secondary near end acoustic and electrical signals; and

an adaptive filter coupled to the combiner for receiving the single combined reference signal as input, the adaptive filter having filter coefficients adapted to cancel a combination of an electrical and an acoustical echo in a near end signal by modeling in parallel the electrical echo, caused by imperfect impedance matching of network transmission sections, comprising at least a portion of the primary telephony signal and the acoustical echo comprising at least a portion of the secondary audio signal.

The Examiner raises a number of alleged enablement issues, which will be dealt with sequentially.

Enablement Issue - Same Driving Point

First, the Examiner has restated the alleged enablement issue previously raised in the December 17, 2008 Office Action, by stating "that applicant has claimed a system with both a hybrid and speaker microphone coupled to the same driving point (as shown in applicant's figure 7)." *Office Action at p. 2.* The Examiner has not responded to the detailed response on this particular issue, and therefore Applicants maintain their previously filed response on this issue, which is provided below for convenience.

As noted earlier, the Examiner contends that FIG. 7 shows "a hybrid and speaker microphone coupled to the same driving point." However, FIG. 7 illustrates a simplified

diagram of an exemplary stereo echo cancellation system that provides acoustic and electric echo cancellation. This simplified diagram highlights the three echoes of interest, namely an acoustical echo from a music/audio signal, an acoustical echo from the phone loudspeaker, and the electrical echo from the hybrid. In FIG. 7, the acoustical echo from a music/audio signal is shown as a dotted line from speaker 328 to microphone 330. In FIG. 7, the acoustical echo from the phone loudspeaker is shown as a dotted line from loudspeaker 329 to microphone 330. Instead of showing hybrid 166 (as shown in FIG. 1), the transfer function relating to the electrical echo created by hybrid 166 is shown and marked as "Hybrid H." As the simplified diagram FIG. 7 depicts, the two acoustic echoes emerging from microphone 330 as an electric signal merge with the electrical echo resulting from the imperfections of the hybrid. Referring to FIG. 7, the specification notes that "[a]nalog near end samples 332 having audio/music feedback and far end speech echo are received by an analog to digital converter 334." *See specification at page 19, Lns. 1-4.* FIG. 8 continues the simplified illustration by showing transfer functions 400, 402, 404 for these three echoes, with the two acoustic signals traversing microphone 330 before joining the echo resulting from the hybrid and then being input to the ADC Converter.

Samples from the secondary audio signal and the far-end voice signal are captured in order to provide inputs to the echo cancellation system in an exemplary echo cancellation system. As the specifications notes with respect to FIG. 7, "combiner 301 combines a downsampled secondary audio signal 340(a) and far end reference signal 300 into a single 8 kHz combined reference signal 301(a)." *See specification at page 14, Lns. 14-17.* The combined reference signal 301(a) is then fed into adaptive filter 200.

Enablement Issue - Electrical Echo in the Claims

Next, the Examiner notes that "applicant has stated that the electrical echo in the claims is not referring to any parasitic coupling at the interface." *Office Action at p. 2.* Applicants note that the Examiner's comment was first made in the Office Action dated July 10, 2008, and appears to be referring to Applicant's reply dated March 26, 2008. In that reply, Applicants traversed the Examiner's previous contention "that the only electrical echo that may be produced by hybrid H of Fig 7, is parasitic electrical echo between components on the circuit board." *See Applicant's Reply dated March 26, 2008, p. 11.* Applicants reiterate that an electrical echo is generated at the two-wire to four-wire interface, and also bring to the Examiner's attention the following passage from the specification:

"an echo is generated from an impedance mismatch created by a two-wire to four-wire interface in hybrid circuitry 100. Ideally the hybrid gain would be zero to eliminate coupling between the far end and near end transmission paths. However, the operation of the hybrid 100 typically results in a frequency dependent gain of less than about one-half. Hybrid gain commonly results in line echoes, such as the reflection of the talker's voice at the mismatch created by the two-four wire conversion." *Specification, p. 5, lns. 19-26.*

Enablement Issue - Same Signal V(n)

Examiner notes that "applicant's figure 7 shows the **same** signal V(n) going to both the Hybrid H and the speaker 329." *Office Action at p. 3.* The Examiner continues by stating that there "is no well known configuration where this occurs." *Id.* The Examiner further asserts that the "drawing is not accurate, and there is not an accurate description of exactly where the acoustic and electrical echo come from." *Id.*

Applicants respectfully disagree. Hybrid H is not physical hybrid 166 illustrated in FIG. 5, but a representation or model of the imperfections of hybrid 166. Hybrid H is not designated by reference designator 166 and should **not** be construed to be hybrid 166. Put simply, Hybrid H is not an actual physical component that can be soldered to another physical component. Thus, it is without validity to assert that there is "no well known configuration," as stated in the Office Action at p. 3, when such an assertion is based on the misconception that Hybrid H is a physical component. Like many diagrams in electrical engineering, elements may represent or model particular characteristics of a component (in this case the undesired transfer characteristics of a hybrid) which are of particular interest in a circuit or system. This type of representation is shown in FIG. 7, and continues in FIG. 8, where the imperfections of hybrid 166 are reflected in the transfer function H_{hy_v} (Electrical Hybrid Transfer Function) 400. Like Hybrid H, H_{hy_v} 400 is not a physical component that can be soldered to another physical component, but an abstraction of the particular characteristic of interest. In particular, as FIG. 8 highlights, adaptive filter 200 seeks to model the parallel transfer functions of the three paths shown. FIG. 8 also illustrates that 2 of the 3 signals originate from "Far-end Voice ($V(n)$)", with one path including an acoustic path via loudspeaker 329 and microphone 330, and the other path including an electrical path through hybrid 166. From a modeling point of view, both of these paths originate from "Far-end Voice ($V(n)$)", and therefore 2 of the 3 signals are derived from $V(n)$. Consequently, in FIG. 7, signal $V(n)$ is rightfully input to both loudspeaker 329 and Hybrid H, with the input to loudspeaker 329 necessary for the acoustic feedback spurious signal modeling and the input to Hybrid H necessary for the hybrid imperfections signal modeling. FIG. 8 also

illustrates the same connectivity for signal $V(n)$ as that described above with respect to FIG. 7. Accordingly, the fact that the same signal $V(n)$ goes into Hybrid H and loudspeaker 329 is correct and does not present an enablement issue.

Enablement Issue – Source Differentiation

The Examiner also contends that it "is not clear how applicant's claimed adaptive filter would differentiate between the two sources of echo by using the same reference input signal 300." Applicants respond by stating that neither claim 1 nor any other claim recites a feature of differentiation between two sources of echo. Instead, for example, claim 1 recites "the adaptive filter having filter coefficients adapted to cancel a **combination** of an electrical and an acoustical echo." Therefore, Applicants contend that because differentiation is not a claimed feature, no enablement issue can arise based on differentiation.

Enablement Issue – Algorithm Taking Account of All Processing Circuitry

The Examiner also asserts that the "applicant's specification does not disclose an algorithm that is able to take into account all of the processing circuitry from the output of Hybrid through the acoustic feedback path." *Office Action at p. 4.* The Examiner continues by indicating that "Applicant's drawings do not even show any of the other circuitry." Applicants respond by noting that the Figures illustrate the architectural concept to which embodiments of the invention apply. Within this architectural concept, the adaptive algorithm seeks to cancel the undesired signals from the near end signal 204. Different circuit design choices of components (e.g., resistors, capacitors, inductors, integrated circuits, etc.) are permissible within this architectural concept. Such circuit design choices that fit within the architectural concept illustrated in the

specification and figures do not pose an enablement issue for the following reason. The effects of such circuitry will be accommodated by corresponding changes in transfer functions 400, 402 and 404, as illustrated in FIG. 8, and thereby such changes will be modeled by adaptive filter 200. Accordingly, components beyond those shown in the Figures in the specification (i.e., collateral components such as resistors, capacitors, integrated circuits, etc.) are not required to be shown for the purpose of enablement, but would readily fall within the skill of one of ordinary skill in the pertinent art.

Enablement Issue – Electrical and Acoustic Echo Differentiation

The Examiner further raises the question of "[h]ow will the adaptive algorithm differentiate which is electrical echo and which is acoustic echo?" As noted above, Applicants respond by stating that neither claim 1 nor any other claim recites a feature of differentiation between the electrical echo and the acoustic echo. Instead, for example, claim 1 recites "the adaptive filter having filter coefficients adapted to cancel a **combination** of an electrical and an acoustical echo." Therefore, Applicants contend that as differentiation is not a claimed feature, no enablement issue can arise.

Enablement Issue – Adaptive Algorithm Issue

The Examiner has also raised the question of "[h]ow will the adaptive algorithm take into account the hybrid, the electrical echo, the communications medium, the telephone interface and the acoustic echo path when trying to adapt to the acoustic echo?" The question implies that the effects of these individual components need to be identified in order for the adaptive filter to function, and therefore to make or use the claimed invention. Applicants respectfully disagree. As noted above, the claims, exemplified by claim 1, do not claim to model individual effects of these individual

components. Instead, the claimed adaptive filter models the overall effect of these individual effects, as that overall effect is revealed in the near end signal 204. As FIG. 8 further illustrates, the three transfer functions represent the cumulative effects of the individual components that form each of the paths by which undesired signals materialize in near end signal 204. Thus, since the cumulative effects of these individual components are claimed but not the individual effects, then no enablement issue arises with respect to the individual contribution of the individual components.

Enablement Issue – Combiner

The Examiner further notes that the "combiner" mentioned in applicant's arguments has nothing to do with the acoustic echo path. Without further explanation, it is not clear how to respond. Applicants' previously presented arguments in the Office Action reply dated March 17, 2009 refer to a "combiner" in the context of recitation of features of claim 1. Moreover, FIG. 7 illustrates combiner 301, with further details provided in the specification. *See, e.g., Specification, p. 14, lns. 15-17.* Thus, Applicants contend that the combiner is enabled, and request that if the Examiner continues to raise an enablement issue with respect to the combiner that the Examiner provide clarification.

Enablement Issue – Music Generation Block Derived Unwanted Signal

The Examiner further notes that that "Applicant states that Figure 7 highlights three areas of echo. One of them being the music generation block 326. This is not echo, this is seen as an interference source to the echo canceller." Applicants respond by noting that FIGs. 7 and 8 illustrate signal $M(n)$ being forwarded to combiner 301 for modeling the unwanted signal through loudspeaker 328 before input to ADC 334. Thus, this signal is provided to adaptive filter 200 to cancel an unwanted signal.

Enablement Issue – Adaptive Algorithm

Finally, the Examiner notes that "Applicant's remarks have not disclosed any indication of an adaptive algorithm that will perform the claimed functions in the disclosed configuration." *Office Action at p. 4.* Applicants respectfully disagree and highlight the following passage of the specification:

The adaptive filter may be **linear transversal filter** or other **suitable finite impulse response filter**. The adaptive filter 200 may again be based upon a normalized least mean square algorithm (NLMS) as described in S. Haykin, Adaptive Filter Theory, and T. Parsons, Voice and Speech Processing. The adaptive filter 200 may again use an error signal feedback control as previously described with regards to FIG. 5. *Specification at p. 19 (emphasis added).*

Accordingly, Applicants contend that this passage resolves this alleged enablement issue.

Summary

Based on the above analysis, Applicants contend that the specification discloses how to make and use the invention. Accordingly, Applicants therefore respectfully request that the rejection to claim 1 be withdrawn.

With respect to the remaining claims 2-39, claim 1 is representative of the features claimed. In the absence of specific rejections in the Office Action for each of the claims 2-39, Applicants believe that the above analysis addresses the remaining claims 2-39. Accordingly, Applicants therefore respectfully request that the rejections to claims 2-39 be reconsidered and withdrawn.

Conclusion

All of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn. Applicants believe that a full and complete reply has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Prompt and favorable consideration of this Amendment and Reply is respectfully requested.

Respectfully submitted,

STERNE, KESSLER, GOLDSTEIN & FOX P.L.L.C.



Michael D. Specht
Attorney for Applicants
Registration No. 54,463

Date: July 15, 2009

1100 New York Avenue, N.W.
Washington, D.C. 20005-3934
(202) 371-2600

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